

WHAT IS CLAIMED IS:

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1. An optical transmission system comprising
a transmitting-end optical transmission device, a
receiving-end optical transmission device and an
optical transmission line connecting the
transmitting-end and receiving-end optical
transmission devices,

the transmitting-end optical transmission
device comprising:

encoding means having n outputs, for forming
 k data by aligning phases of data on k channels with
each other and for generating $(n-k)$ error correction
bits for said k data and adding said $(n-k)$ error
correction bits to said k data; and

wavelength-multiplexing means connected to
the encoding means, for converting both said k data
and said $(n-k)$ error correction bits to n optical
signals having different wavelengths and for
wavelength-multiplexing said n optical signals so as
to be delivered to the optical transmission line, and

the receiving-end optical transmission
device comprising:

wavelength-demultiplexing means for
separating the wavelength-multiplexed optical signals
from the optical transmission line into n optical
signals, each corresponding to one of the different
wavelengths; and

decoding means connected to the
wavelength-multiplexing means, for generating k error
corrected data by correcting error bits using the $(n-k)$
error correction bits contained in said n separated
optical signals.

2. An optical transmission system comprising a transmitting-end optical transmission device, a receiving-end optical transmission device and an optical transmission line connecting the transmitting-end and receiving-end optical transmission devices,

the transmitting-end optical transmission device comprising:

parity generating means for forming k data by adding an SOH (Section Over Head) including at least an error monitoring byte to data on k channels and combining phases of said data with each other and for generating a parity bit for said k data and adding said parity bit to said k data; and

wavelength-multiplexing means connected to the parity generating means, for converting said k data and said parity bit to (k+1) optical signals having different wavelengths and for wavelength-multiplexing said (k+1) optical signals so as to be delivered to the optical transmission line, and

the receiving-end optical transmission device comprising:

wavelength-demultiplexing means for separating the wavelength-multiplexed optical signals from the optical transmission line into (k+1) optical signals, each corresponding to one of the different wavelengths; and

error correction means connected to the wavelength-demultiplexing means, for correcting errors based on one result of a parity check for said separated (k+1) optical signals and the other result of a parity check using said at least one error monitoring byte.

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3. An optical transmission system comprising
5 a transmitting-end optical transmission device, a
receiving-end optical transmission device and an
optical transmission line connecting the
transmitting-end and receiving-end optical
transmission devices,
10 the transmitting-end optical transmission
device comprising:
encoding means having k input and n outputs,
for generating $(n-k)$ error correction bits for every
transmission data having k bits; and
15 wavelength-multiplexing means connected to
the encoding means, for converting said transmission
data and said $(n-k)$ error correction bits to n optical
signals having different wavelengths and for
wavelength-multiplexing said n optical signals so as
20 to be delivered to the optical transmission line, and
the receiving-end optical transmission
device comprising:
wavelength-demultiplexing means for
separating the wavelength-multiplexed optical signals
25 from the optical transmission line into n optical
signals, each corresponding to one of the different
wavelengths; and
decoding means connected to the
wavelength-multiplexing means, for correcting error
30 bits of data having k bits contained in said n separated
optical signals by using said $(n-k)$ error correction
bits contained in said n separated optical signals.

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4. An optical transmission system comprising

a transmitting-end optical transmission device, a receiving-end optical transmission device and an optical transmission line connecting the transmitting-end and receiving-end optical transmission devices,

the transmitting-end optical transmission device comprising:

encoding means having k input and n output, for generating $(n-k)$ error correction bits for transmission data on k channels and adding the $(n-k)$ error correction bits to the transmission data so as to form a sequence of n data;

multiplexing and frame generating means connected to the encoding means, for adding a frame synchronization information to each data in the sequence of the n data and time-division-multiplexing the n data; and

electrical-optical converting means connected to the multiplexing and frame generating means, for converting the time-division-multiplexed n data into n optical signals so as to deliver the n optical signals to the optical transmission line, and

the receiving-end optical transmission device comprising:

optical-electrical converting means for converting the n optical signals via the optical transmission line to electrical signals;

separating means connected to the optical-electrical converting means, for separating the electrical signals into a sequence of n data by detecting the frame synchronization information; and

decoding means connected to the separating means, for performing error correction decoding for a sequence of k data from said separated sequence of the n data using a sequence of $(n-k)$ data from said separated sequence of the n data.

5. An optical transmission device
5 comprising:
encoding means having k inputs, for forming
 n data by generating $(n-k)$ error correction bits for
 k data corresponding to k channels and adding the $(n-k)$
error correction bits to the k data;
10 phase alignment means for aligning phases of
the n data received from the encoding means;
electrical-optical converting means for
converting the n data aligned in phase by the phase
alignment means to n optical signals having different
15 wavelengths; and
wavelength-multiplexing means for
multiplexing the n optical signals having the
different wavelengths received from the
electrical-optical converting means so as to form
20 wavelength-multiplexed signals.

25 6. An optical transmission device
comprising:
wavelength-demultiplexing means for
separating wavelength-multiplexed optical signals
having n wavelengths into n optical signals
30 corresponding to the n wavelengths;
optical-electrical converting means
connected to the wavelength-demultiplexing means, for
receiving and converting the separated n optical
signals corresponding to the n wavelengths into n
35 electrical signals; and
decoding means for performing an error
correction decoding for k data contained in the n

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electrical signals converted by the optical-
electrical converting means using $(n-k)$ error
correction bits contained in said n electrical
signals.

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7. An optical transmission device
10 comprising:
frame generating and SOH inserting means for
adding an SOH (Section Over Head) to data for each of
 k channels such that all the k data can be aligned in
phase by means of a frame synchronization byte within
15 each SOH;
encoding means having n outputs and
connected to the frame generating and SOH inserting
means, for receiving the k data with the SOH,
generating $(n-k)$ error correction bits for the k data
20 without taking the frame synchronization bytes into
account, adding a frame synchronization byte to each
of the $(n-k)$ error correction bits and forming n data,
each of the n data including its frame synchronization
byte, by combining the $(n-k)$ error correction bits and
25 the k data corresponding to the k channels;
electrical-optical means for converting the
 n data from the encoding means into n optical signals
having different wavelengths; and
wavelength-multiplexing means connected to
30 the electrical-optical converting means, for
multiplexing the n optical signals from the
electrical-optical converting means so as to form
wavelength-multiplexed signals.

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8. An optical transmission device comprising:

wavelength-demultiplexing means for separating wavelength-multiplexed optical signals having n wavelengths into n optical signals corresponding to the n wavelengths;

optical-electrical converting means connected to the wavelength-demultiplexing means, for receiving and converting the separated n optical signals corresponding to the n wavelengths into n electrical signals;

frame top detecting means for detecting a top of a frame for each of the n electrical signals converted by the optical-electrical converting means;

memory means for storing the n electrical signals converted by the optical-electrical converting means and outputting the stored n electrical signals such that the tops of the frames detected by the frame top detecting means are aligned with each other;

decoding means for performing an error correction decoding for k data contained in the n electrical signals converted by the optical-electrical converting means using $(n-k)$ error correction bits contained in said n electrical signals; and

SOH (Section Over Head) terminating means for receiving the k data from the decoding means and terminating an SOH for said every k data.

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9. An optical transmission device comprising:

SOH inserting means for adding an SOH (Section Over Head) including an error monitoring byte

to data for each of k channels;

parity generating means for receiving the data for each of the k channels from the SOH inserting means, calculating and adding a parity to the data so as to generate $(k+1)$ data;

phase alignment means for aligning phases of the $(k+1)$ data received from the parity generating means;

electrical-optical converting means for converting the $(k+1)$ data whose phases are aligned by the phase alignment means to $(k+1)$ optical signals having different phases; and

wavelength-multiplexing means for multiplexing the $(k+1)$ optical signals from the electrical-optical converting means so as to form wavelength-multiplexed signals.

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10. An optical transmission device comprising:

wavelength-demultiplexing means for separating $(k+1)$ multiplexed optical signals into $(k+1)$ optical signals having $(k+1)$ wavelengths, respectively;

optical-electrical converting means for receiving the separated $(k+1)$ optical signals from the wavelength-demultiplexing means and converting said $(k+1)$ optical signals into $(k+1)$ electrical signals;

parity detection means for receiving the $(k+1)$ electrical signals received from the optical-electrical converting means and locating a bit position of an error bit by checking a parity contained in said received $(k+1)$ electrical signals and by performing parity check for each data of the k electrical signals corresponding to k channels using

at least one error monitoring byte attached to said
k electrical signals; and

error correction means for performing an
error correction at the bit position of the error bit
5 located by the parity detection means.

10 11. An optical transmission device
comprising:

encoding means having k inputs and n outputs,
for generating (n-k) error correction bits for every
k bits of transmission data;

15 phase alignment means for aligning both tops
of the transmission data having the k bits and the (n-k)
error correction bits in phase;

electrical-optical converting means for
converting the transmission data and the error
20 correction bits aligned in phase with one another by
the phase alignment means to optical signals having
different wavelengths;

wavelength-multiplexing means for receiving
from the electrical-optical means and multiplexing the
25 optical signals having the different wavelengths.

30 12. An optical transmission device
comprising:

wavelength-demultiplexing means for
separating wavelength-multiplexed optical signals
into n optical signals having different wavelengths;

35 optical-electrical converting means for
converting the n optical signals having the different
wavelengths to n electrical signals including k bits

representing transmission data;

decoding means receiving the n electrical signals from the optical-electrical converting means, for performing error correction decoding for every said k bits using $(n-k)$ bits representing error correction bits.

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13. An optical transmission device comprising:

encoding means having k input and n output, for generating $(n-k)$ error correction bits for transmission data on k channels and adding the $(n-k)$ error correction bits to the transmission data so as to form a sequence of n data;

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20 multiplexing and frame generating means connected to the encoding means, for adding a frame synchronization information to each data in the sequence of the n data and time-division-multiplexing the n data; and

25 electrical-optical converting means connected to the multiplexing and frame generating means, for converting the time-division-multiplexed n data into n optical signals so as to deliver the n optical signals to an optical transmission line.

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14. An optical transmission device comprising:

35 optical-electrical converting means for converting time-division-multiplexed signals to electrical signals;

separating means connected to the

optical-electrical converting means, for separating the electrical signals into a sequence of n data including k bits representing transmission data and $(n-k)$ bits representing error correction bits by
5 detecting a frame synchronization information; and decoding means connected to the separating means, for performing error correction decoding for every said k bits using said $(n-k)$ error correction bits.

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15 15. An optical transmission device having n channels comprising:

encoding means for generating error correction bits for m data corresponding to any m channels of k channels representing transmission data, k being less than n and a number of the error correction
20 bits being $(n-k)$;

identification signal inserting means connected to the encoding means, for inserting an identification signal into each of the m data and the $(n-k)$ error correction bits from the encoding means;

25 multiplexing means connected to the identification signal inserting means, for time-division-multiplexing $(k-m)$ data rather than said m data in the transmission data, and, said m data as well as said $(n-k)$ error correction bits; and

30 electrical-optical converting means for receiving from the multiplexing means and converting the time-division-multiplexed signals to optical signals.

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16. An optical transmission device having n channels comprising:

optical-electrical converting means for converting time-division-multiplexed signals including k data representing transmission data for k channels in the n channels and $(n-k)$ error correction bits to n electrical signals;

separating means for separating the n electrical signals receiving from the optical-electrical converting means into a sequence of n data;

identification signal detecting means for detecting m data and the $(n-k)$ error correction bits in the sequence of the n data received from the separating means, each of the m data and the $(n-k)$ error correction bits having an identification signal; and

decoding means receiving the k data and the $(n-k)$ error correction bits from the identification signal detecting means, for performing error correction decoding on the m data using the $(n-k)$ error correction bits.

17. An optical transmission device having n channels comprising:

encoding means receiving m data corresponding to any m channels of k channels representing transmission data and $(k-m)$ fixed data, for generating $(n-k)$ error correction, k being less than n ;

identification signal inserting means connected to the encoding means, for inserting an identification signal into each of the m data and the $(n-k)$ error correction bits;

multiplexing means connected to the identification signal inserting means, for time-

division-multiplexing (k-m) data rather than said m data in the transmission data, and, said m data as well as said (n-k) error correction bits; and

5 electrical-optical converting means for receiving from the multiplexing means and converting the time-division-multiplexed signals to optical signals.

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18. An optical transmission device having n channels comprising:

15 optical-electrical converting means for converting time-division-multiplexed signals including k data representing transmission data for k channels in the n channels and (n-k) error correction bits to n electrical signals;

20 separating means for separating the n electrical signals receiving from the optical-electrical converting means into a sequence of n data;

25 identification signal detecting means for detecting m data and the (n-k) error correction bits in the sequence of the n data received from the separating means, each of the m data and the (n-k) error correction bits having an identification signal; and

30 decoding means receiving the m data as well as the (n-k) error correction bits from the identification signal detecting means and (k-m) fixed data, for performing error correction decoding on the m data using the (n-k) error correction bits.

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19. An optical transmission device comprising:

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decoding means for performing an error

correction decoding for k data contained in the n
electrical signals converted by the optical-
electrical converting means using (n-k) error
correction bits contained in said n electrical
5 signals; and

SOH (Section Over Head) terminating means
for receiving the k data from the decoding means and
terminating an SOH for said every k data.

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